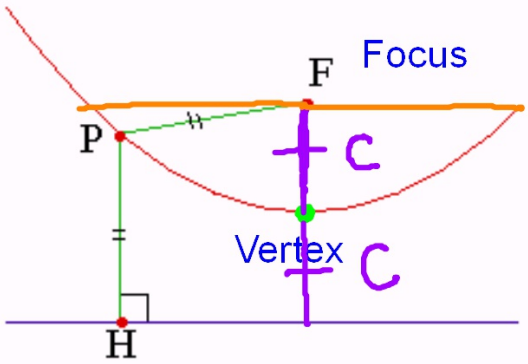
Introduction Video

CONICS!!!

Objective: Write equations of parabolas
Describe parabolas from their equations

Parabola is: a set of points equidistant from a point called the focus and a line called the directrix



- vertex is midpt of focus & directrix
- $|c|$ = focal length
- focal width width of parabola through focus $|4c|$

<u>vertical Axis</u> U/∩

$y = a(x-h)^2 + k$

vertex (h,k)

<u>horizontal Axis</u> ⊃/⊂

$x = a(y-k)^2 + h$

$V(h,k)$

$a = \frac{1}{4c}$

8.1
Conic Sections and Parabolas

Defining_Proper_Conic_Sections.flv

BEST VIDEO EVER

Find the vertex, focus, directrix and focal width of the parabolas

$a.\ x^2 = 6y$

$y = \frac{1}{6}x^2$ or $y = \frac{1}{6}(x-0)^2 + 0$

up

vertex $(0,0)$

$\frac{1}{6} = \frac{1}{4c}$

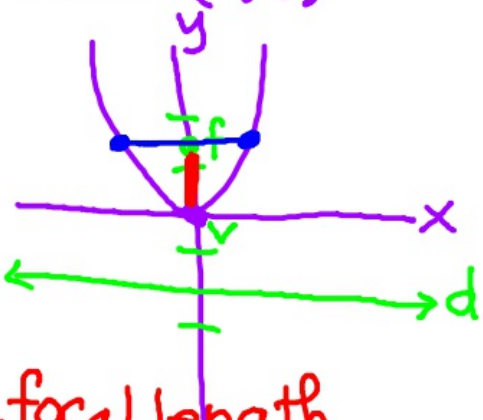
$4c = 6$

$c = \frac{3}{2}$

$f(0,0)$

$+\frac{3}{2}$

$f(0, \frac{3}{2})$



directrix: $y = 0 - \frac{3}{2} = -\frac{3}{2}$

$y = -\frac{3}{2}$

focal length

dist from vertex to focus: $|c|$

focal width

how wide parabola is through the focus

$|4c|$

b. $(y-2)^2 = 4(x+3)$

$\frac{1}{4}(y-2)^2 = (x+3)$

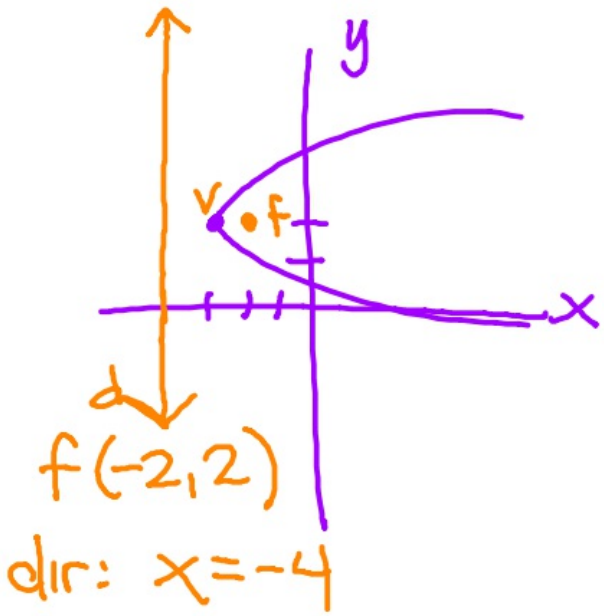
$\frac{1}{4}(y-2)^2 - 3 = x$

right

V(-3, 2)

$\frac{1}{4} = \frac{1}{4c}$

c = 1 = focal length.



c. $3x^2 = -4y$

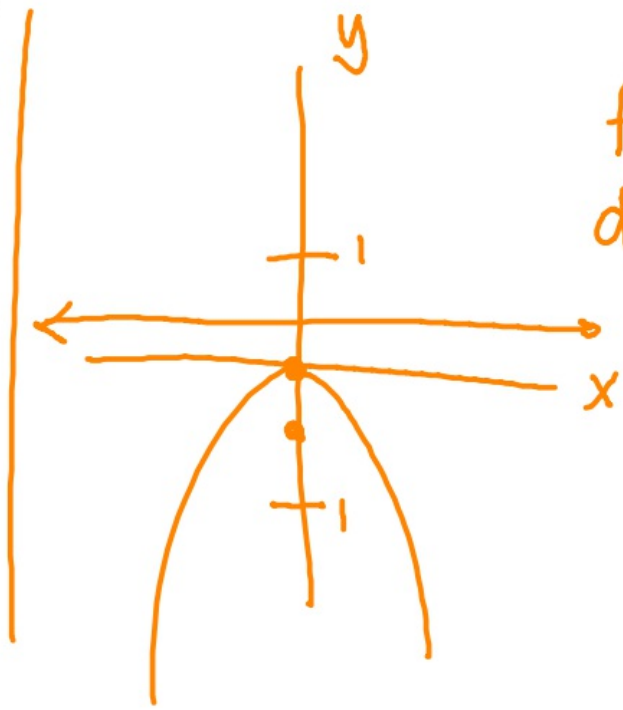
$y = -\frac{3}{4}x^2$

$V(0,0)$

$\frac{1}{4c} = \frac{-3}{4}$

$-12c = 4$

$c = -\frac{1}{3}$

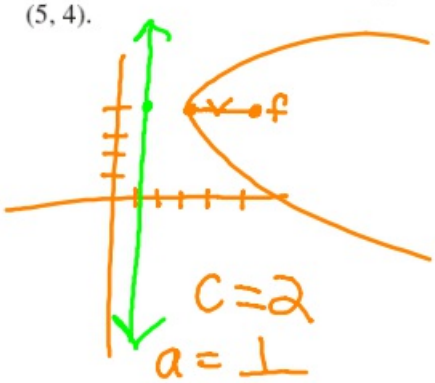


$f(0, -1/3)$

$d: y = \frac{1}{3}$

Finding an Equation of a Parabola (always sketch first!!!!)

1. Find the standard form of the equation for the parabola with vertex (3, 4) and focus (5, 4).



$x = a(y-k)^2 + h$

$x = a(y-4)^2 + 3$

$x = \frac{1}{8}(y-4)^2 + 3$

$c = 2$

$a = \frac{1}{4c}$

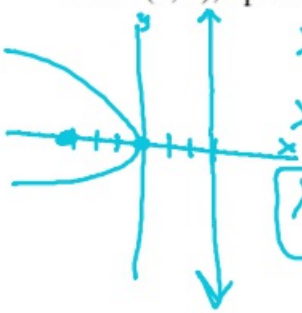
$a = \frac{1}{4(2)} = \frac{1}{8}$

directrix: $x = 1$

2. Vertex (0, 0), opens to the left, focal width = 12

$12 = 4c$

$c = 3$



$x = a(y-k)^2 + h$

$x = a(y-0)^2 + 0$ or $x = ay^2$

$x = -\frac{1}{12}(y-0)^2 + 0$ or $x = -\frac{1}{12}y^2$

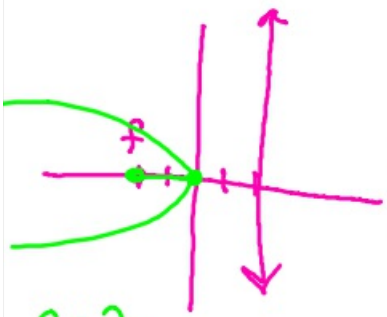
$f(-3,0)$

$d: x = 3$

$a = \frac{1}{4c}$

$a = \frac{-1}{12}$

3. Find an equation in standard form for the parabola whose directrix is the line $x = 2$ and whose focus is the point $(-2, 0)$.



$x = a(y-k)^2 + h$

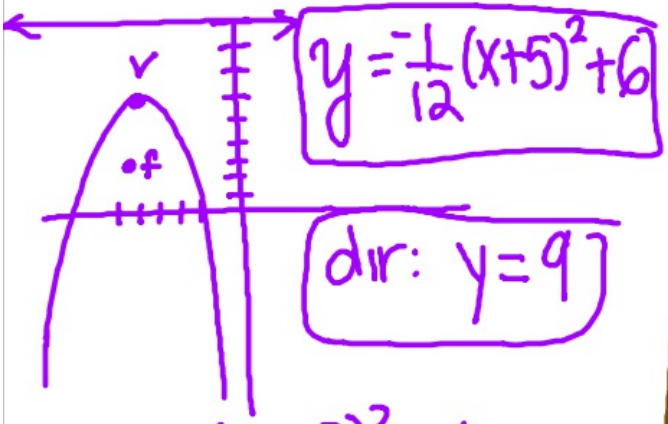
$x = ay^2$

$x = -\frac{1}{8}y^2$

$c = 2$

$a = \frac{1}{4(2)} = \frac{-1}{8}$

4. Vertex (-5,6), focus (-5,3)



$y = -\frac{1}{12}(x+5)^2+6$

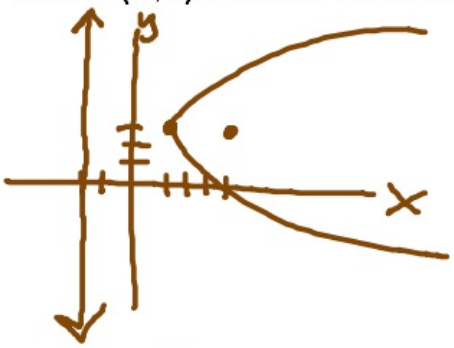
dir: $y=9$

$y = a(x+5)^2+6$

$c = 3$

$a = \frac{1}{4c} = \frac{1}{12}$

5. focus (4,3) and directrix at x = -2



$v(1,3)$

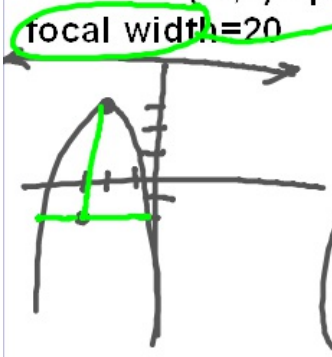
~~$y = a(x-h)^2+k$~~

$x = a(y-k)^2+h$

$x = \frac{1}{12}(y-3)^2+1$

$a = \frac{1}{4c} = \frac{1}{12}$

6. vertex (-3,3) opens downward, focal width=20



$4c = 20$

$\frac{4c}{4} = \frac{20}{4}$

$c = 5$

$f(-3,-2)$

$d: y = 8$

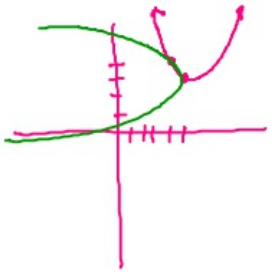
$y = a(x-h)^2+k$

$y = a(x+3)^2+3$

$y = -\frac{1}{20}(x+3)^2+3$

$4c$

7. vertex (5,3) passes through pt.(4.5,4)



bad problem as could go ↑ or ←

Need to know which way it opens!!!

****Completing the square to find the std. form eq. of a parabola

8. Prove that the graph of $y^2 - 6x + 2y + 13 = 0$ is a parabola, and find its vertex, focus, and directrix.

$\frac{1}{2}(2) = (1)^2 = 1$

$y^2 + 2y + 1 = 6x - 13 + 1$

$(y+1)(y+1) = 6x - 12$

$(y+1)^2 = 6(x-2)$

$\frac{1}{6}(y+1)^2 = x-2$

$\frac{1}{6}(y+1)^2 + 2 = x$

9. $x^2 - 2x + 8y + 9 = 0$

$(-2)\frac{1}{2} = (-1)^2 = 1$

$x^2 - 2x + 1 = -8y - 9 + 1$

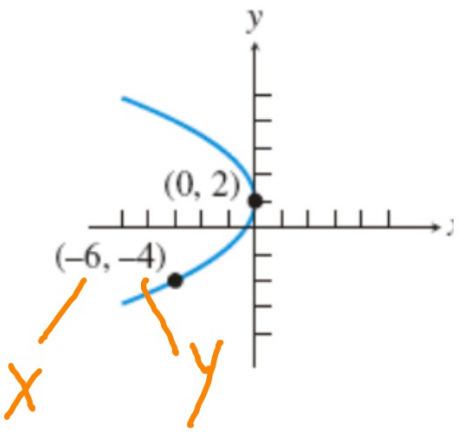
$(x-1)^2 = -8y - 8$

$(x-1)^2 = -8(y+1)$

$-\frac{1}{8}(x-1)^2 = y+1$

$-\frac{1}{8}(x-1)^2 - 1 = y$

10. Write the equation for the parabola.



$x = a(y-k)^2 + h$

$x = a(y-2)^2 + 0$

$-6 = a(-4-2)^2$

$-6 = a(-6)^2$

$-6 = 36a$

$a = -\frac{1}{6}$

$x = -\frac{1}{6}(y-2)^2 + 0$

11. Studying a Parabolic Microphone

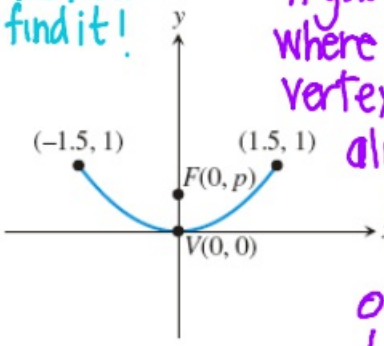
On the sidelines of each of its televised football games, the FBTV network uses a parabolic reflector with a microphone at the reflector's focus to capture the conversations among players on the field. If the parabolic reflector is 3 ft across and 1 ft deep, where should the microphone be placed?

note: not the focal width

↳ not of focal length.

at the focus so find it!

If you are not told where to place vertex of parabola, always place @ origin



up so $y = a(x-h)^2 + k$ (h → 0, k → 0)

vertex @ (0,0) so $y = ax^2$

a pt on curve helps find "a"

I'll use (1.5, 1): $1 = a(1.5)^2$

$a = \frac{4}{9}$

so equation is: $y = \frac{4}{9}x^2$

need focus so: $\frac{4}{9} = \frac{1}{4c}$

$16c = 9$

$c = \frac{9}{16}$

dist from vertex to focus

$\therefore$ $(0, \frac{9}{16})$ is location of microphone

*Make sure you understand that "c" is the distance from vertex to focus AND the distance from vertex to directrix.

*The absolute value of "c" is the **focal length**.

*The absolute value of "4c" is the **focal width**.

*equation begins with x if left/right and y if up/down

*the letter the equation begins with matches the letter in the directrix equation

****ALWAYS MAKE A SKETCH***...let the graph "speak to you" to help you find the parts you need.